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PATENT SPECIFICATION



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COMPLETE SPECIFICATION

Improvements in Valve Mechanism for controlling Hydraulic Pressure

We, PAULINE SCHOENING, ALEXANDER SCHOENING and BRIGITTA SCHOENING, all German nationals, of 54, Ludolfinger Weg, Berlin-Frohnau, Germany, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

10 The invention relates to control mechanism for hydraulically actuated friction clutches for machine tools and the like.

15 In a machine tool it is frequently necessary to engage the clutch with varying degrees of force, for example in cutting screw threads, particularly in blanks of light metal. In the case of hydraulically actuated friction clutches such regulation cannot be effected by means of a throttle in the pressure conduit, because all the throttle does is to retard the engagement of the clutch.

25 In connection with compressed air mechanism for starting motor cars and other purposes it has been proposed to arrange between a compressed air reservoir and the actuated apparatus a piston valve with an adjustably spring loaded piston controlling ports whereby it is adapted to establish communication between a supply conduit and a delivery conduit, and adapted also under the influence of excess pressure in the delivery conduit to place that conduit in communication with a port discharging the surplus air to waste.

35 With hydraulically actuated mechanism and a continuously working pump, usually pumping oil with a relief valve for disposing of surplus oil, it is of course, for economic reasons not practicable to let the liquid run to waste, and if the liquid is discharged into a tank from which it is sucked by the pump there is the disadvantage that after a time the circulating oil becomes hot.

45 According to our invention we use a piston valve controlling ports as for the piston valve of the compressed air mechanism above described in combination with an accumulator disposed between it and the liquid pump, so that

the pump need only work periodically, for re-charging the accumulator, and the circulating liquid does not become unduly hot, a relief conduit being provided to connect the discharge port with the tank from which the pump sucks. 55

The invention is illustrated in the accompanying drawings, showing one form of construction by way of example. 60

Fig. 1 is a diagrammatic view of the apparatus as a whole and

Figs. 2 to 5 are longitudinal sections of the regulating valve in different positions. 65

A pump 1 takes oil from a container 2 through a suction conduit 3, and delivers it through a conduit 4 to a hydraulic accumulator 5, in which a plunger 6 is forced upwards by the oil against the action of a spring 7, so that when the accumulator is full there is available a maximum oil pressure of, for example, 10 atm. A conduit 8 leads from the accumulator to a regulating valve 9, which can be adjusted for delivering at a selected constant pressure, the adjustment being effected by means of a hand lever 10 and cam 11. This pressure is transmitted by a conduit 12 to a cylinder 13, in which there is a piston 14 connected to the clutch to be actuated. The force exerted by this piston 14 is dependent on the oil pressure in the conduit 12, and this is regulatable by means of the valve 9. 70 75 80 85

Fig. 1 shows the piston 14 connected with a plate clutch 15 by means of the linkage 16. 90

The regulating valve 9 comprises a cylinder 18 with a sleeve 19 therein, and in this sleeve there is a piston 20. The delivery conduit 8 from the accumulator is connected at 8' to the cylinder 18, and the conduit 12 is connected to the cylinder at 12'. There is also a discharge conduit 17 connected to the cylinder at 17'. The piston 20 is urged by a spring 21 towards its left hand end position, shown in Fig. 2, in which a collar 22 on its right hand end abuts against the sleeve 19. The piston 20 has an annular channel 23 and a longitudinal bore 24 leading to the left hand end of the piston, 95 100 105

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said bore communicating with the annular channel 23 by means of radial bores 25. When the piston is in the position shown in Fig. 2 the channel 23 faces a port 26 in the sleeve 19 leading to the port 8¹ of the cylinder 18, and thus to the pipe 8. The sleeve 19 also has a tapered slot 27, which communicates with the port 17¹. When the piston 20 moves to the right, against the action of the spring 21, the slot 27 is gradually uncovered. The spring 21 engages with its left-hand end into a recess 28 in the piston 20 and with its right hand end into a recess 29 in a piston 30 which slides in the cylinder 18. This piston 30 is thrust into the cylinder 18, compressing the spring 21, by the cam 11 already referred to, which is rotated about a shaft 31 by means of the hand lever 10.

Fig. 2 shows the position of the cam 11 in which the least pressure is exerted on the piston 30 and thus on the spring 21. The spring 21 is then only very slightly compressed, with no more force than is required to hold the piston 20 in its left hand end position. When the accumulator is full the whole of the oil pressure is transmitted through the conduit 8, the port 26, the channel 23 and the bores 25, 24 to the conduit 12 leading to the cylinder 13. As, however, the piston 20 is only under very slight pressure from the right it is at once moved by the reaction to the position shown in Fig. 3, in which it closes the port 26 and cuts off the oil flow from the conduit 8. The piston 14 is consequently not moved. Should the piston 20, by moving to the right, place its annular channel 23 in communication with the triangular slot 27 the conduit 12 will communicate by means of the bores 24, 25 with the discharge conduit 17, so that there will be no pressure at all in the conduit 12.

To engage the clutch, the hand lever 10 is moved in the direction of the arrow to the position shown in Fig. 4. This causes the piston 30 to move to the left, compressing the spring 21, so that the spring moves the piston 20 to its left-hand end position, shown in Fig. 2, and the conduit 8 is connected to the conduit 12, causing the clutch to be engaged. The clutch pressure is, however, limited to the stress of the spring 21, because if the oil pressure in the conduit 12 exceeds the force of the spring 21 the piston 20 moves to the right under the pressure in the conduit 12 and thereby closes the conduit 8, as shown in Fig. 4. When the piston 20 has closed the conduit 8 the annular channel 23 communicates with the slot 27, so that some oil flows out the

conduit 12 through the conduit 17. The pressure in the conduit 12 thus drops slightly, so that the piston 20 moves to the left until the pressure in the conduit 12 balances the force of the spring 21. The communication between the channel 23 and slot 27 is indicated in Fig. 4 by broken lines. With the piston 20 in the position of equilibrium the conduits 8 and 17 are closed by the piston. The distance of the inlet aperture 26 from the orifice 27 of the discharge conduit 17 is at least equal to the width of the channel 23, and may exceed it.

Fig. 5 shows the position of the hand lever 10 for obtaining maximum clutch pressure. The cam 11 moves the piston 30 still further to the left and thus compresses the spring 21 more than in the position shown in Fig. 4. The piston 20 is then first forced to its left hand end position so that the conduit 8 is connected to the conduit 12. This position is shown in Fig. 5. The piston 20 first moves to the right under comparatively high counter pressure of the oil in the conduit 12, and assumes the position shown in Fig. 4. Owing to the high oil pressure the clutch 15 is then completely engaged.

The disengagement of the clutch is effected by the lever being moved back to the position shown in Fig. 2, so that the spring is relaxed and consequently the piston 20 is moved for discharge of the pressure oil from the conduit 12.

In the example shown in the drawings the control lever for the clutch is directly connected to the cam acting on the regulating valve 9. Obviously the regulating valve 9 may also be pre-set independently of the clutch control lever by the cam 11 and an adjustable stud connected thereto. In this case the control lever 10 is not connected to the cam but to a valve in another part of the pressure conduit. Instead of a cam a screw, inclined plane or the like may be used to allow of exact adjustment.

We are aware that for the regulation of internal combustion engines it has been proposed to use a spring loaded piston valve controlling a supply port and a delivery port, the spring tending to hold the piston in a position in which it establishes communication between these ports, but the valve cylinder having also a discharge port which is uncovered by the piston when the back pressure at the delivery port overpowers the spring, the supply port being then covered.

Having now particularly described and ascertained the nature of our said invention, and in what manner the same is to be performed, we declare that what we

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claim is:—

1. Control mechanism for hydraulically actuated friction clutches comprising in combination with a pump supplying the liquid under pressure an accumulator charged with liquid by the pump and a control valve between the accumulator and the clutch, said valve being a piston valve having an adjustably spring loaded piston controlling ports whereby it is adapted to establish communication between a supply conduit leading from the accumulator and a delivery conduit leading to the clutch mechanism, and also adapted under the influence of hydraulic reaction in the line to cut off the supply and place the delivery conduit in communication with a relief conduit till the reaction pressure is balanced by the spring pressure, said relief conduit discharging into a tank from which the pump sucks.

2. Valve mechanism as claimed in

claim 1, wherein the piston has an annular channel and a longitudinal bore communicating with said channel by means of radial bores, said longitudinal bore leading to the delivery conduit, and the distance between the supply port and the relief port being at least equal to the width of said channel.

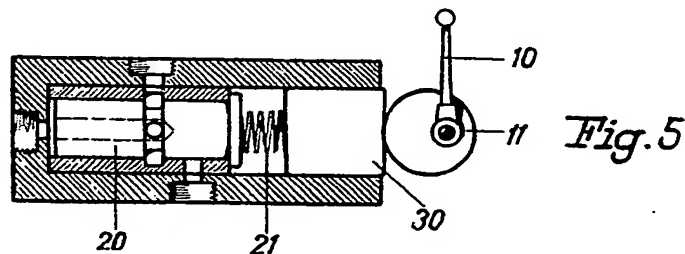
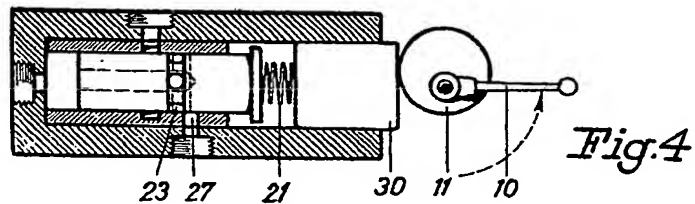
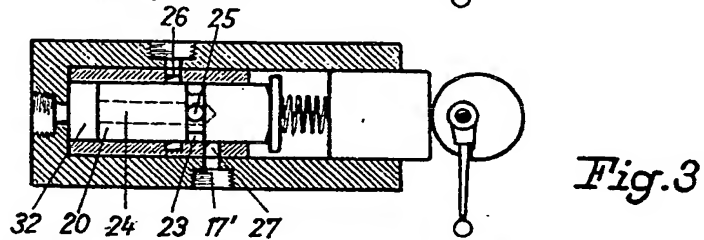
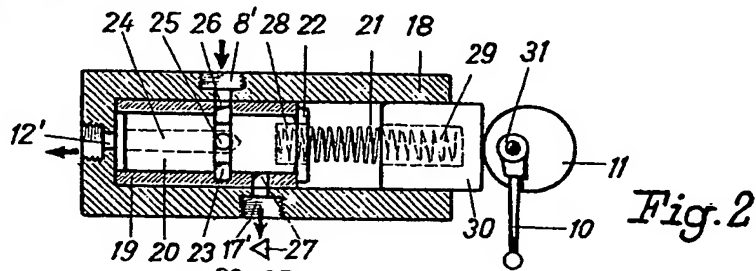
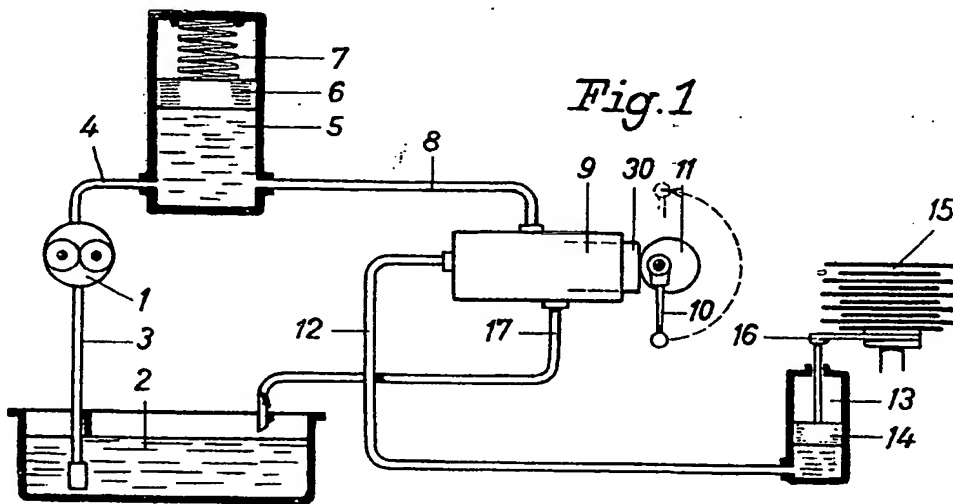
3. Valve mechanism as claimed in claim 1 or 2, wherein the piston valve is controlled by means of a hand lever acting through a cam or equivalent device on a spring so disposed that with the lever adjusted for the minimum spring pressure the clutch is disengaged, and with the lever adjusted for maximum spring pressure the clutch is fully engaged.

Dated this 3rd day of February, 1939.

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